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AN INVESTIGATION OF THE DEGRADATION AND STABILIZATION  
OF POLYMER SYSTEMS

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## AN INVESTIGATION OF THE DEGRADATION AND STABILIZATION OF POLYMER SYSTEMS

The project on "Investigation of the Degradation and Stabilization of Polymer Systems" concentrated primarily on a detailed study of the factors which effect the photolytic decomposition of polyurethanes based on aromatic diisocyanates. An extensive investigation of the photophysics of 1,5-naphthalene diisocyanate based polyurethanes in solution was also conducted. In addition, ground work was laid to initiate studies on the photodegradation of polycarbonate, polyureas, and polyimides.

Employing both steady state and time resolved fluorescence spectroscopy to analyze the photolysis products of model compounds and polyurethane films, photo-Fries and other cleavage products were identified at the very early stages of photolytic induced decomposition. We also clearly established the critical effect of polymer main-chain flexibility, crystalline content, and hydrogen bonding on the extent of degradation of polyurethane films and coatings. Laser flash photolysis results confirmed the contribution of peroxide and aromatic ketone impurities (incorporated into all commercial polyurethanes during the synthesis and processing steps) to the photodegradation process. For methylene 4,4'-diphenyl diisocyanate (MDI) based polyurethanes, transient spectra of diphenyl methyl radicals were detected under a variety of conditions, thus providing unequivocal evidence for one of the primary modes of the initial stages of photooxidation of segmental polyurethane elastomers. a complete mechanistic description was developed to describe the degradation process.

A photophysical investigation of naphthalene diisocyanate based polyurethanes constituted one of the first detailed accounts of intra-chain excimer formation involving chromophores in the polymer backbone. The extent of the excimer formation was found to be dependent on the goodness/poorness of the solvent medium. The isolated monomer concept was employed to describe the complex fluorescence decay curves obtained for emission in the monomer and excimer emission regions.

Attached for reference are lists of technical reports, published manuscripts, and names of personnel who participated in the research.



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